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A STUDY TO ASSESS THE NUTRITIONAL STATUS OF DIFFERENTLY ABLED CHILDREN ON THE BASIS OF CLINICAL EVIDENCE, ANTHROPOMETRIC INDICATORS AND DIETARY INTAKE

Paediatrics

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ABSTRACT

Objectives
1.To study the incidence and spectrum of malnutrition in differently abled children
2.To analyze the etiology of malnutrition and scope for therapeutic intervention and prevention if any in these children.
Materials And Methods This was a cross sectional observational study undertaken in a tertiary care teaching hospital in 80 children less than 12 years with disabilities . Data was analyzed using SPSS software version 20.0 and appropriate statistical tests. **Results** The study included 80 children with majority of them being male 52 (65%) and 50 (62.5%) belonging to the age group of 4-8 years. Intellectual disability in isolation 36.25% (n=29) and global developmental delay 40.0% (n=32) were the most common disability type and diagnosis seen.11.25% (n=9), 16.25% (n=13), 11.25% (n=9) and 16.25% (n=13) were wasted, overweight, obese and underweight respectively.21.25% (n=17) children were stunted and intellectually disabled children were found to be shorter than other children. Mean hemoglobin level of the study group was 11.76 g/dL with RBC indices suggestive of microcytic hypochromic anemia possibly iron deficiency anemia. Severe differently abled children had more protein and calorie deficits with respect to weight and height irrespective of gender. The most common vitamin deficiency was that of vitamin D, seen in 22 (27.5%) differently abled children. **Conclusion** Malnutrition (both under-nutrition and over-nutrition) in differently abled children occurs with a high prevalence and increases with severity of disability. We remain dependent however, on further research in this field as factors contributing to the nutritional status of these children are complex and a national policy in this regard will help improve their overall care and management.

KEYWORDS

INTRODUCTION
Children with Disabilities (CWD) are euphemistically addressed as children with special needs. As per the World Health Organization (WHO), there are about 9.3 crore children aged 0-14 years who have been labelled as having “moderate or severe disability”.[1] This translates to one in twenty children (5·1%) all over the world. Childhood disability is mostly prevalent in the underdeveloped countries of the world.[1, 2] Malnutrition is on of the prime reasons of mortality in these low-income settings, contributing almost half of the recorded figures in 2011.[3] Malnutrition can thus be associated with childhood disability as it may further increase morbidity and mortality among them.[4,5]

These special children may develop malnutrition through myriad ways:
- Feeding related problems
- Multiple sicknesses needing hospitalization
- Malabsorption
- Facial neglect
- Caregiver fatigue.[6,7,8]

Few studies have dwelled on the interplay between disability and malnutrition and the present evidence is at best inconclusive. Some studies have shown a positive association between them, [9] while others have reported mixed findings, [10] or have demonstrated some association only among children with learning difficulties or cerebral palsy.[6,7,8]

MATERIALS AND METHODS
The present hospital based descriptive cross sectional observational study was undertaken after clearance from the Institutional Ethics Committee. Informed consent was taken from the caregivers for the purpose of the study.

Children with loco-motor, mental or special sensory disability individually or in combination assessed by a competent authority as having disability of moderate to severe degree were included in the study while children with temporary disabilities or disabilities likely to improve were excluded from the study.

Incidence of malnutrition in differently abled children as per previous studies is 28.2 %.[9,10] At 90% level of confidence and alpha error of 5 % and power of 80 % sample size was calculated to be 77 at 10% absolute error of margin. A minimum 80 children with disability were included.

Children were assessed by a Pediatrician and independently by a clinical psychologist for mental disability and the type and severity of **disability** was established as per disability certificate issued by the Government of India. Those with disability percentages in the range 25 – 49 and 50 were labeled as to have moderate and severe disability respectively.

Evaluation of **clinical evidence** of malnutrition was made in the form of pallor, cheilosis, angular stomatitis, bleeding gums or nutritional rickets and other similar findings such as skin and nail changes to establish co-existing micronutrient and vitamin deficiency states. Based on clinical evidence, children detected to have pallor underwent complete blood count (CBC) and serum iron studies i.e. Total Iron Binding Capacity (TIBC) if CBC revealed microcytic hypochromic anemia. Similarly those suspected to have nutritional rickets were subjected to estimation of serum 25-OH vitamin D levels. Serum Vitamin D levels less than 20 ng/ml were considered as to be deficient.

Assessment of nutritional status was made based on **anthropometry indicators** using pre-defined age and diagnosis appropriate cut offs as defined by the World Health Organization. Z score < -2 was taken as underweight, short stature and wasted for weight for age, height for age & weight for height/Body mass index(BMI) respectively. Similarly Z score > +1 on BMI was taken as overweight while Z score > +2 was considered obese.

For all children weight was measured to the nearest 0.1 kg on a digital weighing scale. Height was measured using standard methods using stadiometer to the nearest 0.1 cm. In children with contractures at joints, limb length, trunk and head measurements were combined.

Skinfold thickness was measured with skin calipers at triceps as per standard recommendations and findings documented as less than 5th percentile, normal and more than 95th percentile. Head circumference and mid arm circumference was measured using a meter tape(non-stretchable) to the nearest 0.1 cm.

All study subjects were asked nutritional history over 3 days based on caregiver recall and average was taken for **dietary intake** analysis including total calorie(in Kilocalories/day) and protein intake(in g/Kg/day) with respective deficits compared to ideal values i.e. Recommended Daily Allowances(RDA) based on their median anthropometric reference parameters. These values were further recorded in terms of weight and height i.e. Kcal/Kg and Kcal/cm respectively. Dietary supplements being taken in the form of iron,

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calcium and multivitamins were also enquired about and documented.

The above data was recorded on a proforma and subsequently analyzed using SPSS software latest version. **Descriptive statistics** were used for representation of results. Frequency and percentage values were used for age, sex and disability specific sub-stratified data. Quantitative data was presented with help of mean, median and standard deviation.

RESULTS

The study included 80 differently abled children with a median age of 5 years 9 months (range: 1 year 4 months to 10 years 11 months). The mean age of the study group was 5 years 11 months (standard deviation 2 years 3 months).

Majority of the children (62.5%) belonged to the age group of 4-8 years while there were 28 (35%) female and 52 (65%) male children in the study population as depicted in figure 1.

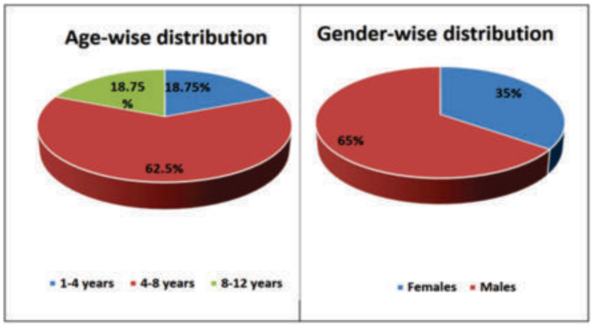

Figure 1: Age and gender- wise distribution

There were less females in the younger age-group (male: female=4:1), however, in the older age groups, the male: female ratio lay between 1 and 2. There was more of severe differently abled children in the younger age groups with decreasing trend in older age groups.

Intellectual disability (36.25%) and learning or speech disability (27.5%) were the most common disability types seen. The most common diagnosis was global developmental delay (40.0%), followed by cerebral palsy (25%), speech delay (11.3%) and attention deficit hyperactivity disorder (7.5%) as shown in figure 2.

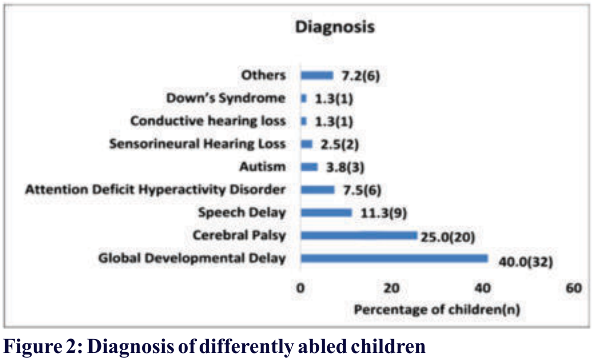

Figure 2: Diagnosis of differently abled children

Median age was 5 years 9 months. Weight for age Z score was -0.61 and height for age Z score was -1.02. Mean weight for height/BMI Z score was 0.026 and mean head circumference Z score was -0.733. Mean mid-arm circumference was 14.1 cm (Age < 5 years). The incidence of shortness (low height for age Z score) increased as age increased across the age groups while no specific trend was observed for the other parameters. On the other hand, severity of disability was seen to have tendency towards mild under-nutrition and severe differently abled children had relatively lower weight for height/BMI Z score compared to moderate differently abled children.

Males were more underweight than females in our study however no significant association could be established. Almost one half to two-thirds children were of normal weight across the various age groups while more proportion of overweight/obese in the older age groups. The shortness ratio of girls was more compared to boys which increased across age groups. All results could not be compared statistically as few categories included no children (e.g. overweight females or children in age group of 1 to 4 years).

The classification of children according to the triceps folds thickness (TFT) centiles and weight for height/BMI and height by age Z-scores was as follows:

18.75% (15) of children had TFT <5th percentile and 13.75% (11) of children had TFT > 95th percentile. The distribution of weight for height/BMI and height for age was as depicted in figure 3 and 4.

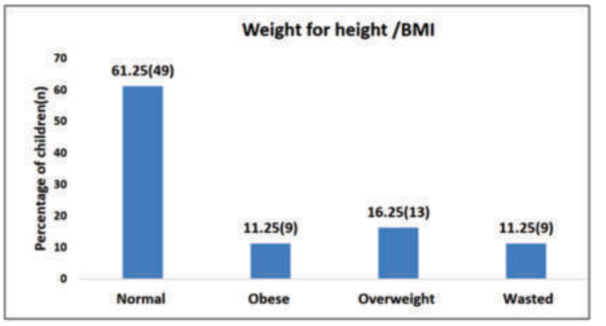

Figure 3 : Weight for height/BMI

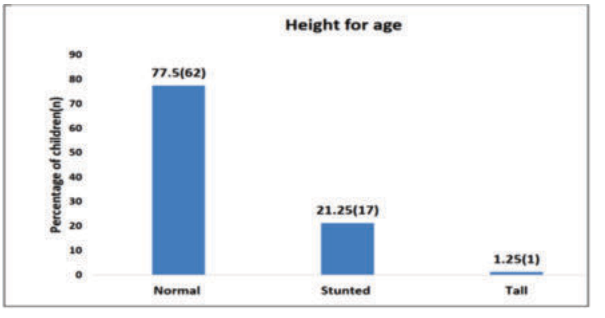

Figure 4 : Height for age

Mean hemoglobin level of the study group was 11.76 g/dL with low MCV and MCH and high RDW suggestive of microcytic hypochromic anemia possibly iron deficiency anemia. Mean±SD values for TIBC were 386±87.49 mcg/dl were also suggestive of the same as shown in table 1. No significant differences were observed with respect to age groups or gender.

Table 1: Hematology measurements across all age groups

Hematology parameters	Median	Minimum	Maximum	Mean	Standard Deviation
Hemoglobin (g/dL)	12.3	8.6	14.2	11.76	1.5
MCV (fL)	60.3	52.8	94	60.59	10.31
MCH (pg/cell)	24.75	20.8	31.6	24.78	2.56
RDW (%)	17	11.7	20.7	16.9	2.10
TIBC (mcg/dl)*	400	210	500	386	87.49

The nutrient measurements in the whole study population and across all age groups and severity of disability in terms of protein and energy consumed per day in relation to height and weight was as follows:

Mean protein deficit per Kg/day was 0.099 while mean calorie deficit was 135.88 Kcal/day. Mean Calorie deficit per unit height and weight was 1.28 Kcal/cm and 7.98 Kcal/Kg respectively. The calorie and protein deficit per unit weight was maximum in age groups 1-4 years followed by 9-12 years while calorie deficit per unit height was maximum in age group 9-12 years. Severe differently abled children had more protein and calorie deficits with respect to weight and height as shown in table 2.

Table 2 : Nutrient measures sub-stratified as per severity of disability

Nutrient measures	Moderate disability	Severe disability
Calorie deficit/unit weight(kcal/kg)	7.275	11.319
Calorie deficit/unit height(kcal/cm)	1.205	1.603
Protein deficit (g/kg/day)	0.090	0.140

Skin, hair and nail changes were present in 8.75% (7) of children. Pallor was observed in 32.5 % (26) of children and anemia (based on hemoglobin levels) was present in 43.80% (35) of children as depicted in figure 5.

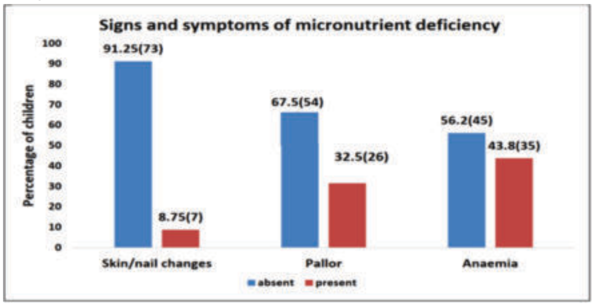

Figure 5: Frequency of signs and symptoms of micronutrient deficiency

There was a significant association between pallor observed during clinical examination and presence of anemia confirmed on laboratory hemoglobin measurements. The most common vitamin deficiency was that of vitamin D, seen in 22 (27.5%) differently abled children. Almost 40% to 50% of children were consuming one or more of iron, calcium, and multivitamin supplements as shown in figure 6. Significantly greater proportion of children with anemia were receiving iron and multivitamin supplements.

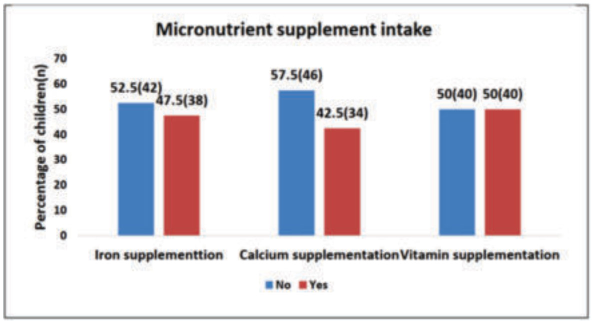

Figure 6: Frequency of intake of iron, calcium, multivitamin supplements

There was significant association only between intellectual disability and Z scores of height for age (P value = 0.023) implying intellectually disabled children were significantly shorter than others while no other associations could be established between disability types and weight or height.

DISCUSSION

Children and adults with disabilities are often given prejudicial treatment compared to the normal population[1]. This can be due to a multitude of reasons, including especially the barriers to communication in both personal and situational domains. In limited resource settings, the biased treatment towards special children may stem from the polarized viewpoint that preserving the health and welfare of such children will not be beneficial than that of other normal child[11].Contrastingly, over-nutrition is also an upcoming problem in upper middle class families owing to lack of knowledge among caregivers about the quality and quantity of food to be given to these special children.

Hakime Nogay N[12] in his study found that out of total 77 children,30 had moderate and 20 had severe mental disability. Abdallah AM et al[13] found that out of the 639 mentally disabled children, almost two-thirds were males. They were classified further into two age groups; (6-<11 years) and (11-<14 years). Similar studies have been done to assess the nutritional status of children 7 – 18 years of economically weaker families by Sari H Y et al[14].

Abdallah AM et al[13] further found that mean values of weight, mid arm circumference and triceps skinfold was higher among females than males, while the mean value of height was higher among males. Sari HY et al[14] found that out of all the 142 children, 70% had normal weight, 5.7% were underweight, 17.1%were overweight, and 7.1% were obese.

Lin JD et al[15] had reported prevalence of obesity to be 18.0% in their study. Abdallah AM et al[13] cross sectional study reported overall prevalence of obesity was 12.0 percent, which increased with regards to age and there was highly statistically significant difference (P<0.001) towards females (15.8%) as compared to males (10.2%).On the other hand, overweight children were 18.5%, with no significant difference between sex.

Abdallah AM et al[13] also reported prevalence of underweight was 14.1% in contrast to those being overweight which was 6.7% and no significant difference between either age or sex was found. On the other hand, the overall prevalence of stunting was 33.5% which was significantly higher (P<0.05) among older age group compared with the younger ones.

Hakime Nogay N[12] study found that the ratio of obesity with regards to BMI was 15.6%, which increased with age and there was sex predilection towards males. Bertoli S et al[16] have similarly found the ratio of obesity as 14% and quoted a spurt in higher ages. Shabaye K[17] study reported that the prevalence of obesity was found to be skewed towards mentally disabled girls.

Raina SK et al[18] study revealed that out of the total 5300 children, 1.7% were diagnosed as mentally retarded and a weak positive association existed between nutritional status and mental retardation leading to the verdict that malnutrition may be one of the causes but certainly not the sole cause of mental retardation.

Abdallah AM et al[13] reported prevalence of iron deficiency anemia were higher among males (41.5%) than females (37.1%) of total mentally disabled children. However, for the age group 6-11 years, anemia was seen more in female than male handicapped children. While, for the age group 11-14 years, the prevalence was marginally higher in males than females.

Hakime Nogay N[12] study found that intake of energy, protein and other multivitamins among girls were higher than that of boys in the 10-13 age group. In the 14-18 age group, the Vitamin C and calcium intakes of girls and the calcium intakes of boys were below the recommended values. Sari HY et al[14] study reported that out of all children studied 61.4% consumed dairy products, 2.9% meat, 34.3% eggs, 58.6% dry legumes, 61.4% vegetables, 62.9% fruits, 98.6% bread and cereal food group, 100% oil, and 11.4% oil seeds every day. Almost half of the surveyed mothers stated that they use foods as a reward.

Bertoli S et al[19] found that the protein and thiamine intake of the children were higher than the recommended values across all age groups. Hurrell RF[20] observed high prevalence of iron deficiency anemia among mentally disabled children may be related to low intake of dietary iron, especially most of them being on exclusively vegetarian diet. Animal sources of iron are more bioavailable than plant ones. Iron deficiency anemia is known to affect cognitive status of young children and thus can have adverse effects on their scholastic performance.

Feeding difficulties were not investigated among our participants in detail as far as feeding time, caregivers knowledge and feeding positions were concerned as done by Yousafzai et al in 2003[6] in an Indian slum which can be considered as a limitation to our study. Lastly, a control group of non- disabled children was lacking in our study which would have been ideal to highlight the burden of malnutrition and associated co-morbidities in the presence of disability.

CONCLUSION

Malnutrition (both under-nutrition and over-nutrition) is highly prevalent in special children which has shown an alarming trend increasing with severity of disability. The nutritional status of *such children* should be followed up closely, and sufficient nutritional support should be provided early to ascertain a normal body weight, linear growth, and an improved quality of life. The essential component preventing the potential detrimental effects of malnutrition is by educating the caregivers in providing an optimal diet and hence, must be one of the major considerations in the care of these children. We remain dependent however, on further research in this field as factors contributing to the nutritional status of these children are complex and a holistic guideline in this regard will help improve their overall care and management.

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